

Mammal Inventories of the Southern Colorado Plateau Network

Including:

Aztec Ruins, Petroglyph, Salinas Pueblo Missions and Yucca House

National Monuments

**Annual Report
for
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EXECUTIVE SUMMARY

In 2001 we initiated inventories of mammals on selected national monuments within the Southern Colorado Plateau Network (SCPN) as part of the National Park Service Inventory and Monitoring project. The overarching goal of these inventory efforts was to document 90% of the mammal species potentially occurring on each park. We worked on four different monuments, Aztec Ruins (AZRU), Petroglyph (PETR), Salinas Pueblo Missions (SAPU), and Yucca House (YUHO), and expended 168 person-days of effort and accumulated 5,608 trap-nights, 42 mist net-nights, and 47.1 detector-hours. We captured 378 mammals of 26 species, including 10 species of bats, 15 species of rodents, and one species of lagomorph. We verified the occurrence of 13 additional species through field observations including three species of carnivores, one ungulate, one rabbit, five bats, and three rodents. An additional 11 species were documented from literature and museum records. Overall, we recognized the presence of 50 species through captures, observations, and museum records. Of note were the captures of several bat species which were Fish and Wildlife Service species of concern, and the capture of hispid cotton rats (*Sigmodon hispidus*) at SAPU, a record for Tarrant County, New Mexico. Efforts at AZRU resulted in the capture of 80 animals and the documentation of 18 species (31% of those estimated as likely to occur). At PETR, we captured 99 mammals and recorded the presence of 25 species (42% of expected). Salinas Pueblo Missions yielded the capture of 157 animals and 33 species (55% of expected). At YUHO, we captured 42 animals and confirmed the presence of 45 species (78% of expected) with the assistance of Marilyn Colyer of MEVE. Levels of documentation vary not only by park but also by mammalian group and we make recommendations for specific work during 2002, along with comments on the current composition of lists of mammals occurring on the parks.

The Colorado Plateau spans the area between the Rocky Mountains and Great Basin and occupies parts of Wyoming, Colorado, Utah, New Mexico, and Arizona; elevations range from 1100-3850 m (3610-12630 ft). The plateau is generally defined as those areas drained by the Colorado River and its tributaries. It is essentially divided into two regions by summer precipitation patterns, with the division reaching from northwestern Arizona to north-central Colorado (Mitchell 1976; Peterson 1994). North of this division most precipitation comes in the winter; to the south, precipitation peaks both in the summer and winter. Two-thirds of the Colorado Plateau lies south of this climatic boundary and is included in the SCPN. Major vegetation types of the southern Colorado Plateau include piñon (*Pinus edulus*) and juniper (*Juniperus* sp.) woodlands, shrubland, and sagebrush steppe with occasional areas of mixed timber, aspen, riparian and wetland vegetation. The Plateau also includes large barren areas and spectacular geological formations.

Historically, several places on the Colorado Plateau have been the subjects of geological and biological explorations. In 1869, J. W. Powell explored and mapped the canyon country of the Colorado River (Powell 1961). In the late 1800s, C.H. Merriam, V. Bailey, M. Cary, and other employees of the Bureau of Biological Survey conducted biological explorations of parts of the area. More recently, university-based researchers such as S.D. Durrant (1952), D.M. Armstrong (1972), J.S. Findley et al. (1975), D.F. Hoffmeister (1986), and J. Fitzgerald et al. (1994) have added to our understanding of the fauna of the Colorado Plateau. Until very recently, access to many areas on the plateau has been difficult and as a consequence, these areas have remained relatively poorly-known.

This relative lack of knowledge about fauna and flora of the plateau applies to most Federal lands, including Fish and Wildlife Service refuges, Bureau of Land Management areas, and National Park Service (NPS) lands. In 2000, the NPS initiated a nationwide Inventory and Monitoring (I&M) Program to facilitate the gathering of information about the ecological resources of national parks and to develop techniques for monitoring those resources. Ultimately, this information will be used to preserve and aid in the stewardship of natural resources by the NPS. In 2001, the Midcontinent Ecological Science Center, U.S. Geological Survey, joined this effort as a cooperator and we conducted surveys for terrestrial and volant mammals occurring on four national monuments in the NPS Southern Colorado Plateau Network (SCPN): Aztec Ruins (AZRU), Petroglyph (PETR), Salinas Pueblo Missions (SAPU), and Yucca House (YUHO). Originally, we were to work on El Morro National Monument (ELMO) but that work is currently on hold. Some information on ELMO is nonetheless included in this report.

At AZRU, approximately 1.6 ha (4 ac) of the more than 129 ha (319 ac) park were previously surveyed for sensitive, threatened, and endangered species (Ecosphere Environmental Services 1996), resulting in a hypothetical species list which included 13 mammals. A survey of biological resources of PETR (Parmenter and Lightfoot 1996; Hafner and Hafner, unpublished data) listed 28 mammal species based on fieldwork and museum collections. Subsequently, PETR was enlarged and the new land had not been inventoried. At SAPU, we are aware of one previous survey for small mammals at Gran Quivira (Scott, unpublished) but not for the other areas (Quarai, Abo) in the park. Contacts at MEVE told us that some work on terrestrial rodents had been done at YUHO and our plan was to conduct bat surveys there. When we coordinated with contacts at MEVE, we were asked to expand our activities to include a general inventory on land (the Ismay property) that is expected to be added to YUHO in the near future (G. San Miguel and M. Colyer, personal communications). The stated NPS objective was to document

90% of the mammal species potentially occurring on each park. This annual report summarizes our progress during the first year of a planned two-year effort. Results presented herein are subject to change upon further examination of references, vouchers, and museum specimens.

METHODS AND MATERIALS

We prepared lists of all mammals that might conceivably occur on each park using Armstrong (1972), and Fitzgerald et al. (1994) for YUHO in Colorado and Findley et al. (1975) for the parks in New Mexico. Additional references for the Colorado Plateau included Clark (1977), Clark and Stromberg (1987), Durrant (1952), Hall (1981), and Hoffmeister (1986). Our park lists were produced both in text (Word) format and in an Excel database. Updated versions of the database for each park are attached to this report (Tables 4-13). We categorized the species on each list as unconfirmed (= unlikely to occur), possibly present (= species likely to occur, range includes or is near the park), and present (= documented by us or others). To assess progress toward documenting 90% of species occurring on a given park, we divided the number of documented species by the number of likely species (possibly present) and multiplied by 100 to obtain a percentage. The SCPN proposal (2000) included estimates of the number of species expected in each park, based on park size. Numbers of species calculated for each park were: AZRU, 26; ELMO, 31; PETR, 38; SAPU, 31; and YUHO, 18.

Inventory methods followed guidelines set forth by Kunz (1988) and Wilson et al. (1996). Trapping methods varied depending on habit of mammals (e.g., terrestrial, volant, nocturnal, diurnal) and habitat complexity. Small- and medium-sized rodents were trapped in Sherman live traps and released unharmed following identification. Trap lines varied from 190-400m long with stations spaced at 10-15m intervals and 1-2 traps at each station. Starting points of trap lines were determined randomly within suitable habitat. Traps were set for 1-2 nights, baited with rolled oats, and checked 1-3 times per day. Traps were closed during daylight hours except for directed efforts for diurnal species. Where possible, traps were set at habitat features (e.g., logs, trees, burrows) but within 2 m of a station. All species captured in Sherman live-traps were presumed to be members of breeding populations within a given park, even if reproductively active individuals were not captured.

Effort for terrestrial mammal trapping was quantified based on number of nights a given number of traps were set (trap-nights) and number of days a given number of people worked (person-days). Estimates of the number of person-days required per year at each park were made prior to commencing fieldwork; estimates of person-days for each park were: AZRU, 28; PETR, 56; SAPU, 56; and YUHO, 16.

We inventoried for bats using capture and acoustic sampling techniques (Kunz and Kurta 1988). Bats were captured and released unharmed using mist nets erected over streams, creeks, ponds, and other suitable sites. Nets ranged in size from 6-20 m and number of nets varied depending on the area of the body of water. Effort was quantified based on number of nets set each night (net-nights).

Where there were no water sources over which mist nets could be deployed, inventories were conducted using acoustic sampling techniques (e.g., bat detector). Acoustic sampling points were randomly selected. Echolocation call sequences inaudible to humans were recorded onto a laptop computer using a bat detector (produces audible output from the ultrasonic calls emitted by echolocating bats), zero-crossing analysis interface module (interfaces the audio-frequency signal from the detector to a computer) and associated software (AnaBat II, Titley

Electronics, Ballina, New South Wales, Australia). The frequency-time displays generated by the software from detected echolocation call sequences were then used to identify species based on qualitative analysis of call parameters compared to reference calls from known individuals (Fenton and Bell 1981; O'Farrell et al. 1999). Acoustic sampling was also coupled with mistnetting to detect species not captured but flying in the area. Acoustic sampling effort was quantified by number of hours equipment was recording (detector-hours). Additionally, audible echolocation calls (such as those from spotted bats, *Euderma maculatum*) were opportunistically noted. Presence of medium- to large-sized mammals was verified using field observations of animals, tracks, and scat; historic and recent museum records and park files; and photographs.

Capture and handling methods of bats and rodents followed a written protocol approved by the USGS Midcontinent Ecological Science Center, Animal Care and Use Committee. Upon capture, bats and rodents were promptly removed from the net or trap, identified to species, other data collected, and then released unharmed. Data included time/date of capture, species, sex, age, reproductive condition, locality, number and size of nets or trapline location, names of investigators, time of deployment and closure of nets, and temperature were recorded on standardized data sheets; most of this information was later transferred to an Excel database that contains additional information as requested by NPS. This database was transferred to the network office.

Age of bats was determined by examining epiphyseal ossification, as described by Anthony (1988). Age of rodents was determined by reproductive condition, size, and pelage color. Reproductive condition of males was determined if cauda epididymides were visible or the testes were scrotal; females were noted as pregnant, lactating, or postlactating for bats and rodents.

Selected voucher specimens were taken to ensure correct identification of species or to document a new record of occurrence; these specimens are noted in the capture database. Bats and rodents were prepared as study skins and skeletal material is being cleaned for identification. Voucher specimens were deposited in the Biological Survey Collection, Museum of Southwestern Biology (MSB), University of New Mexico. Samples of heart, kidneys, and liver were preserved in liquid nitrogen and deposited in the Division of Genomic Resources at the University of New Mexico. Scientific names in this report follow Jones et al. (1997) with the exception of Townsend's big-eared bat (*Corynorhinus townsendii*, Tumlison and Douglas 1992) and western chipmunks (*Eutamias* spp., Hoffmeister 1986). For the most part these names are consistent with the Integrated Taxonomic Information System (ITIS) followed by NPS.

STUDY AREAS

Three of the four parks are located in New Mexico, the fourth, YUHO, is located in southwestern Colorado. GPS and habitat data were entered into computerized forms provided by SCPN and these have been provided to the network office.

Aztec Ruins National Monument. Located north of Aztec, San Juan County, New Mexico, on the west bank of the Animas River, AZRU includes more than 128 ha (317 ac) of Upper Sonoran desertscrub. Dominant vegetation included four-wing saltbush (*Atriplex canescens*), rabbitbrush (*Chrysothamnus* sp.), black greasewood (*Sarcobatus vermiculatus*), and sagebrush (*Artemisia* sp.) with piñon and juniper woodlands on the uplands. Willows (*Salix* sp.) and cottonwoods (*Populus* sp.) bordered the riverbanks and ditches, with cattails (*Typha* sp.) growing in the

marshy areas. The monument also includes some cultivated areas and Ancestral Pueblo ruins. Elevation ranges from 1716-1774 m (5630-5820 ft). We worked throughout the monument.

Petroglyph National Monument. PETR is located on the West Mesa of Albuquerque, Bernalillo County, New Mexico. It includes five volcanic cinder cones, more than 27 km (17 mi) of volcanic basalt escarpment, and encompasses 2,928 ha (7,236 ac) of desert scrub, chaparral, and temperate grassland vegetation types. A sandy wash at the south end of the park also supports willows and junipers. Elevation ranges from 1665-1820 m (5465-5971 ft). Inventory efforts focused on areas not surveyed in previous studies (Parmenter and Lightfoot 1996).

Salinas Pueblo Missions National Monument. SAPU, approximately 64 km (40 mi) southeast of Belen, in Torrance and Socorro counties, New Mexico, encompasses 445 ha (1,100 ac), and consists of three units, each featuring pre-Spanish ruins and Spanish colonial churches: Abó, Quarai, and Gran Quivira. Vegetation was predominantly piñon and juniper woodland with associated desert shrubland. Abó and Quarai also had areas of riparian vegetation. Elevation ranges from 1859-2011 m (6100-6600 ft). We worked at all three units of the monument.

Yucca House National Monument. Located in Montezuma County between the towns of Towaoc and Cortez, Montezuma County, Colorado, at the base of Sleeping Ute Mountain, YUHO includes 4 ha (10 ac) of currently designated parkland. Approximately 1,011 ha (2,500 ac) of surrounding private land, currently owned by the Ismay family, were also sampled in the inventory. Our efforts focused on areas that included big sage (*A. tridentata*), juniper woodland, riparian areas dominated by cottonwoods, a spring near the ruins associated with a marshy area with grasses and sedges, an irrigation ditch lined with grasses and ragweed (*Ambrosia* sp.), and stock ponds surrounded by cottonwoods, willows, and tamarisk (*Tamarix* sp.). Elevation ranges from 1796-1872 m (5892-6142 ft). Inventories were conducted in each habitat type and emphasized netting bats over stock ponds.

RESULTS AND DISCUSSION

Fieldwork was conducted from June to October 2001. We expended 168 person-days (107% of estimated) and accumulated 5,608 trap-nights, 42 mist net-nights, and 47.1 detector-hours (Tables 1, 2). Overall, we documented 50 species of mammals at the four parks. We captured 378 mammals of 26 species, including ten species of bats, 15 species of rodents, and one species of rabbit (Table 3). Overall, the most abundant species was the deer mouse (*Peromyscus maniculatus*), comprising 17.2% of all captures. Of bats captured, the most frequently encountered species was big brown bat (*Eptesicus fuscus*; 33.3% of bats captured). We verified the occurrence of 13 additional species through observations of animals, tracks, scat, and acoustic surveys including three species of carnivores, one ungulate, one rabbit, five bats, and three rodents. Bats comprised 10.3% of total captures and 30.0% of species captured and observed. A search of museum records and literature added 11 species to our list of confirmed species.

The number of person-days we spent on a park was positively correlated with the number of trap-nights amassed on that park although the R^2 value was not high (0.50; Fig. 1). At SAPU we deployed more traps than predicted from person-days of effort while the converse was true at PETR. Efforts (i.e., numbers of traps deployed) at SAPU were purposely increased, whereas at PETR fewer traps were deployed, partly because our early training was conducted there. As planned, effort (person-days) was highly correlated with park size with about 98% of variation in effort being attributed to size of the park (Fig. 2).

Numbers of animals captured was highly correlated with numbers of trap-nights per park ($R^2 = 0.83$; Fig. 3), suggesting that our methods were effective in capturing numbers of individuals. The relationship between number of species captured and number of captures was not as strong ($R^2 = 0.63$; results not figured). In turn suggesting that overall level of species documentation cannot be obtained solely from trapping and that other factors (e.g., habitat factors and climate) also are important in determining capture success.

The general prediction from species-area relationships is that, other things being equal, larger areas will be more species-rich. Interestingly enough, when we compared number of species documented (by all means) against park size the relationship was weakly inverse ($R^2 = 0.35$; Fig. 4), with the smaller parks appearing to exhibit greater species diversity. Whether or not this relationship will hold for these four parks when studies are complete, there are several confounding factors that may contribute to this result. First of all, the supposedly smallest park is YUHO, but we worked on adjacent parts of the Ismay property as well and do not know at present how large an area was actually studied. In addition, Marilyn Colyer recently provided an extensive list of species that she believes occur at YUHO. For the most part, we have accepted these well-documented additions; we do not have similar contributions from other parks. We anticipate generating similar additions to the mammal fauna of the other parks but in this case, Marilyn has helped us considerably. Other factors likely involved in this comparison are that PETR is urban, relatively homogeneous from a small mammal standpoint, and there is no open water over which bats can be netted. Thus, it is possible that at PETR, (some) species will be difficult to document and the fauna may be somewhat impoverished as well.

Individual Park Results

Aztec Ruins National Monument. We conducted mammal inventories at AZRU on 18-21 June, 3-4 and 28-29 July, and 13-16 August. We expended 32 person-days (114% of estimated) and accumulated 1,000 trap-nights trapping terrestrial mammals, 8 net-nights, and 13.8 detector-hours surveying for bats. We inventoried terrestrial mammals in all habitat types and bats at the ruins and over an irrigation ditch.

Eighty mammals of 10 species were captured including three species of bats and seven species of rodents. Capture rate for terrestrial mammals was 7.0%. Three additional species were observed, desert cottontail (*Sylvilagus audubonii*), western spotted skunk (*Spilogale gracilis*), and mule deer (*Odocoileus hemionus*); three were documented using acoustic surveys; and two were verified from Findley et al. (1975): spotted bat (*Euderma maculatum*) and black-tailed jackrabbit (*Lepus californicus*). Three additional species are very likely to occur: rock squirrel (*Spermophilus variegatus*), meadow vole (*Microtus pennsylvanicus*), and Botta's pocket gopher (*Thomomys bottae*; Findley et al. 1975).

Abundance varied greatly among all species captured. The most abundant terrestrial species captured at AZRU were western harvest mouse (*Reithrodontomys megalotis*) and the non-native house mouse (*Mus musculus*), representing 28.6% and 27.1% of captures in Sherman traps, respectively, while deer mice, the third most abundant species, accounted for 17.1% of captures. The least commonly captured species were northern grasshopper mouse (*Onychomys leucogaster*; 1.4%), desert cottontail (*Sylvilagus auduboni*; 2.9%), and brush mouse (*Peromyscus boylii*; 2.9%). Females comprised 40% of animals captured. For most species, numbers of females and males were similar. The exception was deer mice, which had a female-to-male ratio of 1:5.

The location with the highest species richness for terrestrial mammals was the piñon-juniper woodland on the mesa top in the NW corner of the park, where five species were captured. We captured four species at three other locations: the mesa top N of the ruins (piñon-juniper), the draw between the hills at the NE corner of the park (piñon-juniper), and the irrigation ditch approximately 0.8 km NE of the ruins (juniper and cottonwood).

Bats accounted for 12.5% of all captures and 31.8% of species documented at AZRU. Of bat captures, big brown bat was most abundant (70.0%), while pallid bats (*Antrozous pallidus*) and western small-footed myotis (*Myotis ciliolabrum*) comprised 20.0% and 10.0% of bat captures, respectively. All bats captured were females, and all, except two juveniles (a western small-footed myotis and a pallid bat), were lactating.

Acoustic surveys were used to detect bats concurrently with mistnetting at the irrigation ditch and at the Great Kiva. One hundred fourteen sequence files were recorded, 80.7% of which contained an adequate number of complete calls to make species identifications. Preliminary analysis of echolocation recordings revealed seven species, three of which were not captured in mist nets: Yuma myotis (*M. yumanensis*), Brazilian free-tailed bat (*Tadarida brasiliensis*), and big free-tailed bat (*Nyctinomops macrotis*). Species richness for bats was highest at the irrigation ditch and Great Kiva, where five species were documented. Species common to both sites were western small-footed myotis, pallid bat, and big brown bat. Brazilian free-tailed bat and big free-tailed bat were detected only at the Great Kiva site, and Yuma myotis was detected only at the irrigation ditch.

To date, we have confirmed the presence of 18 species of mammals at AZRU (Table 4). This figure represents 69% of the species pool estimated by SCPN (26) and 31% of our current estimate of species likely to occur (58). These differing estimates of species occurring at AZRU clearly affect the proportion of species documented to date. Using our list as a standard, lagomorphs are well documented (100%) but considerable verification remains to be done for bats (43% documented), rodents (30%), and carnivores (7%; Table 5). Efforts in 2002 should target these groups.

Petroglyph National Monument. We visited PETR on 4-6, 10-14 and 17 June; 27 September; and 2 and 9 October. Terrestrial mammals were trapped in all habitats; we surveyed for bats on the west side of the monument near Butte Volcano in a desert scrub community using the AnaBat II system. During seventy person-days (125% of estimated) we accrued 1,772 trap-nights, captured 99 animals of six species, recorded one species, and observed three additional species (Table 8). Capture rate for Sherman traps was 5.6%.

The three most abundant species captured at PETR were cactus mouse (*P. eremicus*; 35.4% of captures), deer mouse (22.2% of captures), and white-throated woodrat (*Neotoma albigula*; 21.2% of captures). Uncommon species captured were northern grasshopper mouse (4.0% of captures) and silky pocket mouse (*Perognathus flavus*; 4.0% of captures). A single desert cottontail (*Sylvilagus audubonii*) was also captured (1.0% of captures). Many desert cottontails were also observed; this species appeared to be common on the park.

We amassed 1.2 detector-hours and six sequence file recordings during acoustic surveys for bats. Of those six files only one originated from a bat, the remainder were recordings of electrical interference. The bat that was detected was a big free-tailed bat flying near Butte Volcano. While conducting acoustic surveys for bats at PETR, we experienced equipment malfunction and were unable to complete the surveys. The bat detector and associated interface device received interference from an unknown source. As a result, we were able to record only a single bat sequence file. During 2002, we will conduct additional acoustic surveys at PETR.

Species richness was highest at Vulcan Volcano where five species were captured (white-throated woodrat, deer mouse, cactus mouse, silky pocket mouse, and northern grasshopper mouse). Two additional locations with relatively high species richness were JA Volcano (white-throated woodrat, deer mouse, silky pocket mouse, northern grasshopper mouse) and the bottom of the escarpment on the S side of Rinconada Mesa (Ord's kangaroo rat [*Dipodomys ordii*], white-throated woodrat, deer mouse, and cactus mouse). Females comprised 36% of captures at PETR. Number of females and males were equal for northern grasshopper mouse and silky pocket mouse, and nearly equal for deer mice. Several species exhibited disproportionate female-to-male sex ratios: Ord's kangaroo rat, 1:11; white-throated woodrat, 1:2; and cactus mouse, 1:1.7.

In addition to the 10 species we documented in 2001, museum and literature records (Museum of Southwestern Biology [MSB]; Parmenter and Lightfoot 1996) confirmed an additional 15 species for a total of 25 species. This figure represents 66% of the predicted number (38 species; SCPN) and 42% of our working list of known or likely species (Table 9). Current levels of documentation are good for lagomorphs (67%) and rodents (75%) but work is needed on insectivores, bats, carnivores, and artiodactyls.

Salinas Pueblo Missions National Monument. Salinas Pueblo Missions was visited 25-29 June; 1-5, 8-12 and 24-26 July; and 19-20 September. We trapped terrestrial mammals in each unit and each vegetation association and bats were netted at Quarai and near the dam at Abó. We expended 44 person-days (78% of estimated) and accrued 2,436 trap-nights, 31 net-nights and 3.3 detector-hours. We captured 157 animals of 21 species, and observed six additional species. Species captured and observed included seven species of bats, 16 species of rodents, two species of rabbits, one species of ungulate, and one carnivore (Table 10). Rate of capture for Sherman live traps was 5.8%. Museum records (MSB) and literature (Scott 1979) confirmed the presence of five additional species.

Three species made up more than half of the terrestrial mammal captures at SAPU: brush mouse (*P. boylii*; 19.9% of captures), white-footed mouse (*P. leucopus*; 18.4%), and white-throated woodrat (14.2%). Seven other species, each represented in the inventory by a single capture, each comprised 0.7% of total captures. Number of females and males for all terrestrial species combined were nearly equal. Individually, however, female-to-male sex ratios varied greatly. Voles (*Microtus* sp.) and white-footed mice had equal sex ratios. Females outnumbered males in captures of Ord's kangaroo rats (1.5:1), white-throated woodrats (2.3:1), northern grasshopper mice (1.8:1), silky pocket mice (4:1), and plains pocket mice (*Perognathus flavescens*, 4:0), while brush mice (1:1.8), deer mice (1:3.3), and hispid cotton rats (*Sigmodon hispidus*, 1:1.7) had more males.

Of bat captures, hoary bat (37.5%) and long-legged myotis (25.0%) were most abundant, while big brown bat and Yuma myotis were least abundant, each comprising 6.3% of bat captures. Bats comprised 10.9% of all mammals captured at SAPU and 20.6% of all species documented. Females comprised 56.3% of bats captured. Within species, hoary bat (*Lasiurus cinereus*) and Yuma myotis were all non-reproductive males, while Townsend's big-eared bat (*Corynorhinus townsendii*), big brown bat, fringed myotis (*M. thysanodes*), and long-legged myotis (*M. volans*) were all females, each having some reproductive individuals. One hundred sixty-five sequence files were recorded during acoustic surveys at Quarai, 156 of which were identifiable. Six species were recognized, all of which were also captured in mist nets at Abó.

Mammal captures at Gran Quivira accounted for 53.5% of all captures at SAPU. Additionally, ten species were captured or observed at Gran Quivira that were not documented in

other units. Abó had four species and Quarai had seven species not captured or observed in other units. Six species were captured or observed in all three units. At present, we have documented 33 species at SAPU (Table 10). This is 103% of the SCPN predicted number of species and 55% of our current working list of likely species. Although our list of likely species may be slightly too inclusive, it is clear to us that the number of species predicted by SCPN is too low.

Lagomorphs (67%) and especially rodents (87%) are moderately well documented, whereas most other groups deserve additional attention during 2002 (Table 11).

Yucca House National Monument. Work was conducted at YUHO and adjacent Ismay property on 28 June-2 July, 30 July-1 August, and 13 September. Most of the effort at YUHO emphasized mistnetting at existing stock ponds on the Ismay property. Twenty-two person-days (137% of estimated although the estimate was for a smaller area), 400 trap-nights, and 26 net-nights were used to document 21 species. We captured 42 mammals of 12 species and observed nine additional species (Table 12). Rate of captures for terrestrial mammals in Sherman traps was 10.5%.

Species diversity was relatively low at YUHO. Nearly half of the captures in Sherman traps were deer mice (48.3%). Other common species were piñon mice (*P. truei*; 31.0%) and brush mice (13.8%). Uncommon species captured included western harvest mouse and white-throated woodrat, each comprising 3.4% of total captures. Females comprised 53.6% of captured terrestrial mammals. Sex ratios were nearly equal for deer mice and piñon mice, whereas female brush mice outnumbered males by 3:1.

Number of species captured varied greatly by location. Species richness was highest at a site 1.3 km (0.8 mi) N of the Ismay house in a sagebrush community, where four species were captured. This was the only location where a white-throated woodrat was captured. The only location to yield a western harvest mouse capture was the north pond W of the Ismay house, where two species were captured. Deer mice were captured at all trapping locations.

Bats comprised 30.9% of all captures and 54.5% of all species observed and captured. The most abundant bat captured was big brown bat (38.5% of bat captures). Males comprised 69.2% of bats captured, all of which were non-reproductive. Of captured females, one long-eared myotis was lactating. Acoustic surveys for bats were used in conjunction with mist netting at stock ponds for 28.8 detector-hours. Three hundred nineteen sequence files were recorded, 83.4% of which contained an adequate number of good quality calls to assign species identifications. Ten species were detected using acoustic methods, four of which were not captured in mist nets: western pipistrelle (*Pipistrellus hesperus*), California myotis, big free-tailed bat, and Brazilian free-tailed bat. The pond E of highway 666, approximately 0.2 km (0.1 mi) S of Road B on the Ismay property was the most speciose location, with nine species of bat documented by mist nets and acoustic surveys. Seven species were documented at the middle pond and five were documented at both the N and S ponds.

In early February we received an updated list of mammal observations for YUHO from Marilyn Colyer at MEVE. With an exception or two, we have added these records to our own, thus documenting the occurrence of 45 species at YUHO and the adjacent Ismay property (Table 12). This is well above the predicted species richness for YUHO (18 species) and is 78% of our list of species likely to occur. Some of our documentation relies on records from nearby localities (Armstrong 1972) but we believe most of these species occur throughout this area. Bats, lagomorphs, and rodents are reasonably well-documented but work is needed to document additional species of carnivores (Table 13).

Factors Affecting Species Documentation

Our current efforts to document mammalian species on parklands are very much a work in progress. This is because several factors affect these efforts. One especially problematic area is exactly what list of species should be used as the measuring stick against which documentation is assessed. We have chosen to use a list of species that we deem “likely” to occur, based on our work, our knowledge of mammals of the Colorado Plateau, and pertinent references. For the most part, these “likely” species are those listed as “Present” or “Probably Present” on the Master Species Lists (Tables 4-13). It seems likely that for some parks, perhaps especially small parks, our lists are currently too inclusive. For larger parks, we suspect that the current lists are probably good “working” lists, at least at this point in time. One park in the Northern Colorado Plateau Network where we have worked extensively is Capitol Reef National Park (CARE). We believe that CARE is close to the 90% level of documentation and that this is the result of multiple years of effort, facilitated by knowledgeable park staff. With only a few exceptions, we have continued to use the same list of possible species throughout our efforts at CARE.

Our estimates for inventory completeness after less than one year of effort differ considerably from those used by the SCPN as “starting points” for this inventory effort (NPS SCPN Proposal 2000). These figures (NPS estimate, followed by our current estimate) for the four parks are: AZRU, 0%, 31%; PETR, 70%, 42%; SAPU, ?, 55%; and YUHO, 75%, 78%. The source of the original estimates is unknown but local park staff probably helped to some extent. We believe that most parks overestimated the extent of documentation and also may have worked from a smaller, less-inclusive list than we are using (small, poorly-known and secretive mammals such as bats and small rodents may have been overlooked). In any case, we believe that the planned second year of effort will help resolve many of these differences by allowing additional species to be documented or, conversely, removed from the working list.

Park size undoubtedly influences species diversity and a variety of mathematical algorithms incorporate size in attempting to predict the numbers of species (but not actual species) that may occur on a park. These algorithms did not, in our opinion, provide meaningful estimates of mammalian diversity on the four parks where we worked. In most cases, our tabulation of number of species likely to occur is about double those in the SCPN proposal. Although our estimates will probably prove to be slightly too high, it seems clear that the original predictions were much too low.

At present, our results at documenting species occurrence on SCPN parks is lowest for AZRU (130ha). This may be a result of using a species list that is too inclusive. Our success at documenting mammals on parks is facilitated by the existence of a good recent treatment of mammals for the state or region. Recent references allow us to construct a more meaningful list of likely species. For the SCPN parks where we worked, the most detailed references are somewhat dated (Armstrong 1972, Findley et al. 1975). Until we can gather more data on both occurrence or absence, especially from interviews with park staff and local wildlife officials, we are disinclined to modify the current lists as we think they represent good lists from which to work.

One factor in assessing species occurrence is the biology of the animals that we are trying to document. It is axiomatic in biology that only a few species are truly common and most others are much less common to rare. The occurrence of common, widespread, and abundant species, such as *P. maniculatus*, is easy to document and our results offer visible proof of this. However, less common and rare species can be very difficult to document and absolute absence

is hard to prove. Another biological phenomenon that can affect the results of our inventory attempts is whether or not the populations of certain species fluctuate over time. Our capture rate for terrestrial mammals on SCPN parks during 2001 was 6.2%. It was our impression, reinforced by considerable experience in trapping on the Colorado Plateau, that population numbers of small mammals were low in 2001. This may correlate with recent climatic factors (e.g., low precipitation) on the plateau and emphasizes the importance of multi-year inventories of small mammals. Climate, especially precipitation, also interacts with species biology in influencing population levels of rodents.

Aspects of climate and especially availability of water affect our ability to inventory some small mammals (especially bats) and interact with features of biology of each species. Bats are dependent on the availability of roosting sites, water sources, and adequate prey. The extent of available water in a given area, as well as subtleties of pond shape and size, can affect capture success of bats (Kunz and Kurta 1988, K. Geluso personal communication). Typically, captures of bats in mist nets are lower when water is abundant, as the bats seem to be more dispersed over the landscape. When water sources are fewer, bats tend to concentrate at those waterholes that are available (and mammalogists exploit this tendency when possible). In general, our level of effort for rodent trapping exceeded the mist-netting effort. This is because, relatively speaking, mist-net sites are limited in occurrence and outnumbered by available trapping locations. Nonetheless, it is not uncommon for the number of bats captured in a given night to exceed the number of rodents captured. This phenomenon likely reflects the limited extent of available water in the area as well as the occurrence of good roosting habitat in nearby cliffs.

Other more proximate factors that may interfere in inventory efforts include inclement weather, which can depress activity of small mammals (and mammalogists) and the efficiency of methods used to inventory them. Rainfall can dissolve bait, cause traps to trigger, and turn mist nets into soggy, non-functional curtains. Likewise, subtle seasonal changes in species natural history or the physical environment may influence our activities.

Some species documented in 2001 were considered rare, uncommon, or poorly known and some are recognized by states as “species of concern.” Some also are former category 2 candidate species (USFWS, 1994). We captured several bat species of concern including the western small-footed myotis at AZRU, Townsend’s big-eared bat, fringed myotis, long-legged myotis and Yuma myotis (*M. yumanensis*) at SAPU, and western small-footed myotis, long-eared myotis (*M. evotis*), fringed myotis, long-legged myotis, and spotted bat at YUHO. Also of note was the capture of eight hispid cotton rats, at the Abó and Quarai units of SAPU. This is a new record for Torrance County, New Mexico.

Although we do not expect extensive changes in identifications, we have not yet finished processing some voucher specimens taken in 2001. Thus, some identifications remain tentative or perhaps even unknown. We are continuing to process this material and will provide updates as they become available. We are also continuing to analyze and identify echolocation call sequences recorded during acoustic surveys for bats.

We are continuing to digest our data from 2001 and reflect on our upcoming field activities in 2002 to further document species that are likely to occur and delete unconfirmed species where that seems appropriate. In 2002, we will focus more of our activities on species or groups that are now known to be poorly documented on a park, and we will likely do less of the widespread trapping done in 2001. In particular, we will use more pitfall traps for insectivores, rely more on bat detectors for bats in parks where netting has not been productive or is not

possible, spend more time attempting to observe some species, and continue interviewing park staff and other knowledgeable individuals for additional information. Where rodents remain to be documented, efforts that are more directed toward those species in their preferred habitat will be used. Finally, we will continue our data mining efforts using published and unpublished literature and voucher specimens in museums.

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Fig. 1. Numbers of trap-nights vs. person-days.

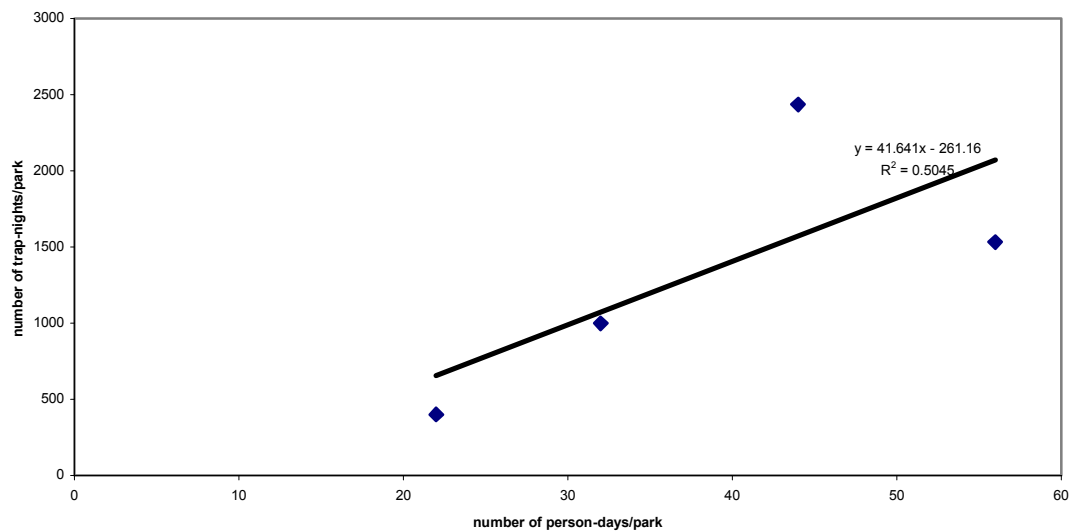


Fig. 2. Effort (person-days) vs. park size.

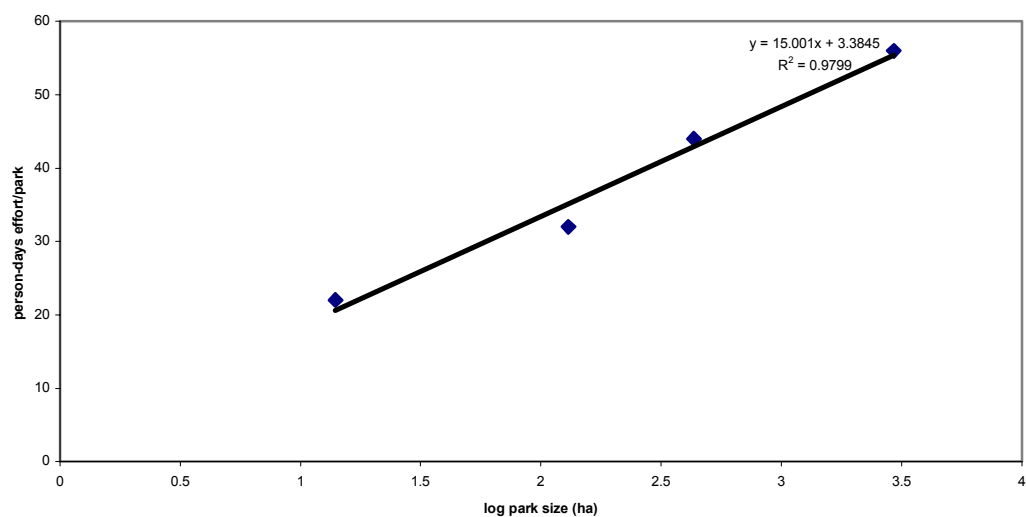


Fig. 3. Captures vs. effort in 2001.

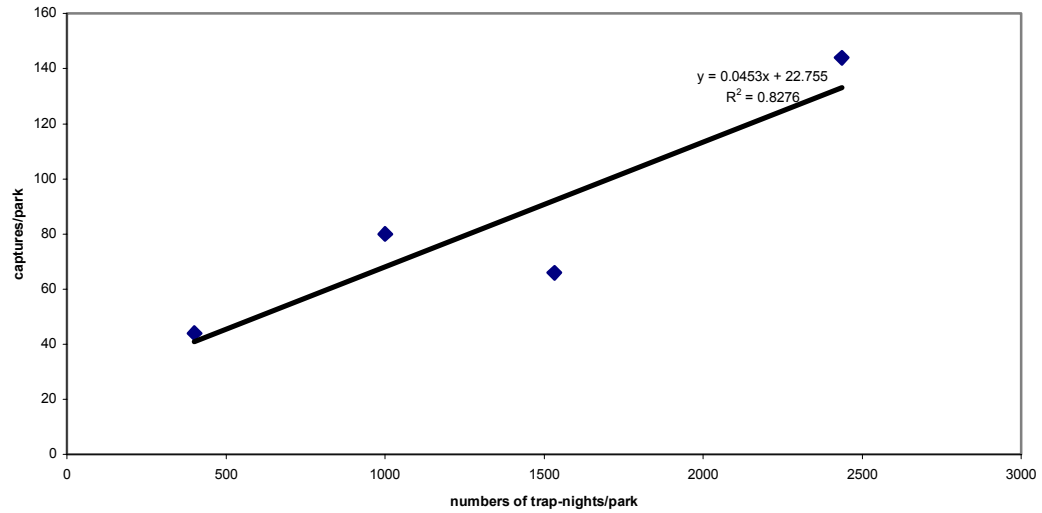


Fig. 4. Species documented from four parks vs. park size.

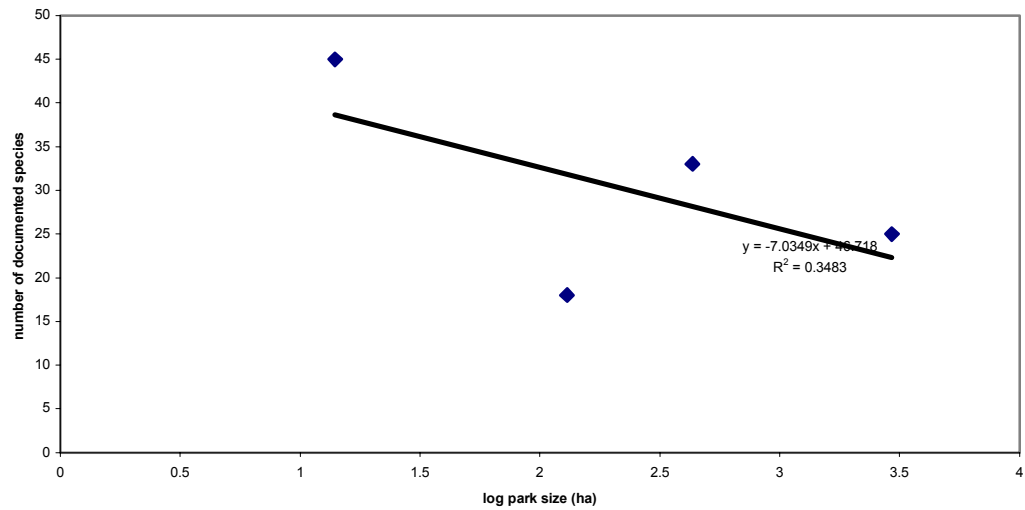


Table 1. Summary of 2001 mammal inventory effort at Aztec Ruins (AZRU), Petroglyph (PETR), Salinas Pueblo Missions (SAPU) and Yucca House (YUHO) national monuments.

Park	<u>Person-days</u>			Trap-nights	Mist-net nights	<u>Species documentation</u>		
	Estimated	Actual	Percent of Est.			No. spp. likely	No. spp. documented	Percent of Expected
AZRU	28	32	114	1000	8	58	18	31
PETR	56	64	114	1532	0	59	25	42
SAPU	56	44	78	2436	8	60	33	55
YUHO	16	22	137	400	26	57	45	78

Table 2. Additional data on park size, numbers of species likely, numbers documented, numbers captured in 2001, effort, trap-nights, and captures for five SCPN parks.

Park	Park Size (ha)	log 10 park size	No. spp. likely	No. spp. documt.	No. spp. in 2001	Person-days	Trap-nights	Captures
AZRU	130	2.113943352	58	18	12	32	1000	80
ELMO	518	2.71432976	54	0	0	0	0	0
PETR	2932	3.467163966	59	25	6	56	1532	66
SAPU	433	2.636487896	60	33	20	44	2436	144
YUHO	14	1.146128036	57	45	12	22	400	44
						154	5368	334

Table 3. Capture summary for 2001 at Aztec Ruins (AZRU), Petroglyph (PETR), Salinas Pueblo Missions (SAPU) and Yucca House (YUHO) national monuments.

Order	Species	Park				Total
		AZRU	PETR	SAPU	YUHO	
Chiroptera	Pallid bat	2				2
	Townsend's big-eared bat			2		2
	Big brown bat	7		1	5	13
	Hoary bat			6	1	7
	Southwestern myotis				2	2
	Western small-footed myotis	1			2	3
	Long-eared myotis				1	1
	Fringed myotis			2	1	3
	Long-legged myotis			4	1	5
	Yuma myotis			1		1
Lagomorpha	Desert cottontail	2	1			3
Rodentia	Least chipmunk			1		1
	Ord's kangaroo rat		12	12		24
	Plains pocket mouse			4		4
	Silky pocket mouse	2		3		5
	Western harvest mouse	20			1	21
	Brush mouse	2		23	4	29
	Cactus mouse		34	1		35
	White-footed mouse	5		26		31
	Deer mouse	12	2	16	13	43
	Piñon mouse	7		1	9	17
	Northern grasshopper mouse	1	2	11		14
	Meadow vole			1		1
	House mouse	19		1		20
	Hispid cotton rat			8		8
	White-throated woodrat		15	20	1	36
Total		80	66	144	44	334

Table 4. Current working list of mammals from Aztec Ruins National Monument.

Common Name	Park Status	Reference/Observation
Merriam's shrew	Unconfirmed	
dwarf shrew	Unconfirmed	
desert shrew	Probably Present	Armstrong, 1972
California myotis	Probably Present	
Western small-footed bat	Present	USGS capture, 2001
long-eared myotis	Probably Present	
little brown bat	Unconfirmed	
Fringed myotis	Probably Present	
long-legged myotis	Probably Present	
Yuma myotis	Present	USGS capture, 2001
silver-haired bat	Probably Present	
western pipistrelle	Probably Present	
big brown bat	Present	USGS capture, 2001
hoary bat	Probably Present	
spotted bat	Present	Rodeck, 1961; Findley et al., 1975
Allen's big-eared bat	Probably Present	
Western big-eared bat	Probably Present	
pallid bat	Present	USGS capture, 2001
Brazilian free-tailed bat	Present	USGS vocalization, 2001
big free-tailed bat	Present	USGS vocalization, 2001
desert cottontail	Present	USGS observation, 2001; Findley et al., 1975
Nuttall's cottontail	Unconfirmed	
black-tailed jack rabbit	Present	Findley et al., 1975
Hopi chipmunk	Unconfirmed	
white-tailed antelope squirrel	Probably Present	
spotted ground squirrel	Probably Present	
rock squirrel	Probably Present	
Gunnison's prairie dog	Unconfirmed	
Botta's pocket gopher	Probably Present	
plains pocket mouse	Probably Present	
silky pocket mouse	Present	USGS capture, 2001; Findley et al., 1975
Ord's kangaroo rat	Probably Present	
Banner-tailed kangaroo rat	Probably Present	
beaver	Probably Present	
western harvest mouse	Present	USGS capture, 2001; Findley et al., 1975
brush mouse	Present	USGS capture, 2001; Findley et al., 1975
canyon mouse	Probably Present	
deer mouse	Present	USGS capture, 2001; Findley et al., 1975
piñon mouse	Present	USGS capture, 2001; Findley et al., 1975

northern grasshopper mouse	Present	USGS capture, 2001
white-throated woodrat	Probably Present	
bushy-tailed woodrat	Probably Present	
Mexican woodrat	Probably Present	
Stephens' woodrat	Probably Present	
montane vole	Unconfirmed	
meadow vole	Probably Present	
muskrat	Probably Present	
house mouse	Present	USGS capture, 2001; Findley et al., 1975
porcupine	Probably Present	
coyote	Probably Present	
gray wolf	Unconfirmed	
kit fox	Probably Present	
red fox	Probably Present	
gray fox	Probably Present	
American black bear	Probably Present	
grizzly bear	Unconfirmed	
ringtail	Probably Present	
raccoon	Probably Present	
long-tailed weasel	Probably Present	
black-footed ferret	Unconfirmed	
mink	Probably Present	
badger	Probably Present	
western spotted skunk	Present	USGS observation, 2001
striped skunk	Probably Present	
mountain lion	Probably Present	
bobcat	Probably Present	
wapiti	Unconfirmed	
mule deer	Present	UGSS observation, 2001
pronghorn	Probably Present	

Table 5. Current level of documentation for major groups of mammals on AZRU.

Order	Number spp. possible	Number spp. likely	Number spp. present	Percent of likely spp.
Insectivora	3	1	0	0
Chiroptera	17	16	7	43
Lagomorpha	3	2	2	100
Rodentia	26	23	7	30
Carnivora	17	14	1	7
Artiodactyla	3	2	1	50
Total	69	58	18	31%

Table 6. Current working list of mammals from El Morro National Monument.

Common Name	Park Status	Reference/Observation
Merriam's shrew	Unconfirmed	
dwarf shrew	Unconfirmed	
desert shrew	Probably Present	
southwestern myotis	Probably Present	
California myotis	Probably Present	
Western small-footed bat	Probably Present	Findley et al., 1975; Zuni Mts.
long-eared myotis	Probably Present	
little brown bat	Probably Present	Findley et al., 1975; Zuni Mts.
Fringed myotis	Probably Present	
long-legged myotis	Probably Present	
Yuma myotis	Probably Present	
silver-haired bat	Probably Present	Findley et al., 1975; Zuni Mts.
Western pipistrelle	Probably Present	
big brown bat	Probably Present	Findley et al., 1975; Zuni Mts.
Western red bat	Unconfirmed	
hoary bat	Probably Present	
Spotted bat	Probably Present	
Allen's big-eared bat	Probably Present	
Western big-eared bat	Probably Present	
pallid bat	Probably Present	
Brazilian free-tailed bat	Probably Present	
big free-tailed bat	Probably Present	
desert cottontail	Probably Present	
Eastern cottontail	Probably Present	Findley et al., 1975
black-tailed jack rabbit	Probably Present	
cliff chipmunk	Probably Present	Findley et al., 1975; Howell, 1929
Colorado chipmunk	Probably Present	Findley et al., 1975; Zuni Mts.
Spotted ground squirrel	Unconfirmed	
Thirteen-lined ground squirrel	Unconfirmed	
rock squirrel	Probably Present	Findley et al., 1975; Zuni Mts.
Gunnison's prairie dog	Probably Present	Findley et al., 1975; Zuni Mts.
Abert's squirrel	Unconfirmed	Findley et al., 1975; Zuni Mts.
red squirrel	Unconfirmed	Findley et al., 1975; Zuni Mts.
Botta's pocket gopher	Probably Present	Findley et al., 1975; Zuni Mts.
Plains pocket mouse	Probably Present	Findley et al., 1975; nr. El Morro
silky pocket mouse	Probably Present	Findley et al., 1975
hispid pocket mouse	Unconfirmed	
Ord's kangaroo rat	Probably Present	Findley et al., 1975; nr. El Morro
Banner-tailed kangaroo rat	Unconfirmed	

beaver	Unconfirmed	
Western harvest mouse	Probably Present	
brush mouse	Probably Present	Findley et al., 1975
white-footed mouse	Unconfirmed	
deer mouse	Probably Present	Findley et al., 1975; Zuni Mts.
piñon mouse	Probably Present	
rock mouse	Unconfirmed	
Northern grasshopper mouse	Probably Present	Findley et al., 1975; nr. El Morro
white-throated woodrat	Probably Present	
Mexican woodrat	Probably Present	Findley et al., 1975; Zuni Mts.
southern plains woodrat	Unconfirmed	
Stephens' woodrat	Probably Present	
Mexican vole	Unconfirmed	Findley et al., 1975; Zuni Mts.
Meadow vole	Unconfirmed	
Muskrat	Unconfirmed	
house mouse	Unconfirmed	
porcupine	Probably Present	Findley et al., 1975; Zuni Mts.
coyote	Probably Present	Findley et al., 1975; Zuni Mts.
gray wolf	Unconfirmed	
kit fox	Probably Present	
red fox	Unconfirmed	
gray fox	Probably Present	Findley et al., 1975
American black bear	Probably Present	
grizzly bear	Unconfirmed	
ringtail	Probably Present	
raccoon	Probably Present	
long-tailed weasel	Probably Present	
black-footed ferret	Unconfirmed	Findley et al., 1975; "Agua Fria"
badger	Probably Present	
Western spotted skunk	Probably Present	
striped skunk	Probably Present	Findley et al., 1975; Zuni Mts.
mountain lion	Probably Present	
bobcat	Probably Present	Findley et al., 1975; Zuni Mts.
wapiti	Probably Present	
mule deer	Probably Present	
pronghorn	Probably Present	
Bighorn sheep	Unconfirmed	

Table 7. Current level of documentation for major groups of mammals on ELMO.

Order	Number spp. possible	Number spp. likely	Number spp. present	Percent of likely spp.
Insectivora	3	1	0	0
Chiroptera	19	18	0	0
Lagomorpha	3	3	0	0
Rodentia	31	17	0	0
Carnivora	16	12	0	0
Artiodactyla	4	3	0	0
Total	76	54	0	0%

Table 8. Current working list of mammals from Petroglyph National Monument.

Common Name	Park Status	Reference/Observation
Merriam's shrew	Unconfirmed	
dwarf shrew	Unconfirmed	
desert shrew	Probably Present	
southwestern myotis	Unconfirmed	
California myotis	Probably Present	
western small-footed bat	Probably Present	
long-eared myotis	Probably Present	
little brown bat	Probably Present	?= M. velifer of Parmenter and Lightfoot?
fringed myotis	Probably Present	
long-legged myotis	Probably Present	
Yuma myotis	Probably Present	
silver-haired bat	Present	MSB specimen
western pipistrelle	Probably Present	
big brown bat	Probably Present	
eastern red bat	Unconfirmed	
hoary bat	Probably Present	
spotted bat	Probably Present	
Allen's big-eared bat	Unconfirmed	
Western big-eared bat	Probably Present	
pallid bat	Probably Present	
Brazilian free-tailed bat	Probably Present	
big free-tailed bat	Present	USGS vocalization, 2001
desert cottontail	Present	USGS observation, 2001; MSB specimen
eastern cottontail	Probably Present	
black-tailed jack rabbit	Present	USGS observation, 2001
cliff chipmunk	Unconfirmed	
white-tailed antelope squirrel	Probably Present	
spotted ground squirrel	Present	MSB specimen
thirteen-lined ground squirrel	Unconfirmed	
rock squirrel	Present	MSB specimen
Gunnison's prairie dog	Unconfirmed	
black-tailed prairie dog	Unconfirmed	
Botta's pocket gopher	Present	MSB specimen
Yellow-faced pocket gopher	Unconfirmed	
rock pocket mouse	Present	MSB specimen
plains pocket mouse	Present	MSB specimen
silky pocket mouse	Present	USGS capture, 2001
hispid pocket mouse	Unconfirmed	
Merriams kangaroo rat	Probably Present	

Ord's kangaroo rat	Present	USGS capture, 2001
Banner-tailed kangaroo rat	Present	MSB specimen
western harvest mouse	Present	MSB specimen
plains harvest mouse	Present	MSB specimen
brush mouse	Probably Present	
cactus mouse	Present	USGS capture, 2001
white-footed mouse	Present	MSB specimen
deer mouse	Present	USGS capture, 2001
piñon mouse	Present	MSB specimen
rock mouse	Probably Present	Parmenter and Lightfoot, 1996
northern grasshopper mouse	Present	USGS capture, 2001
southern grasshopper mouse	Probably Present	
white-throated woodrat	Present	USGS capture, 2001
southern plains woodrat	Present	MSB specimen
house mouse	Present	MSB specimen
porcupine	Probably Present	
coyote	Present	USGS observation, 2001
gray wolf	Unconfirmed	possibly occurred historically
kit fox	Probably Present	
red fox	Probably Present	
gray fox	Probably Present	
American black bear	Probably Present	
grizzly bear	Unconfirmed	possibly occurred historically
ringtail	Probably Present	
raccoon	Probably Present	
long-tailed weasel	Probably Present	
black-footed ferret	Unconfirmed	
badger	Present	Parmenter and Lightfoot, 1996
western spotted skunk	Probably Present	
striped skunk	Present	Parmenter and Lightfoot, 1996
mountain lion	Probably Present	
bobcat	Probably Present	
wapiti	Unconfirmed	
mule deer	Probably Present	
pronghorn	Probably Present	

Table 9. Current level of documentation for major groups of mammals on PETR.

Order	Number spp. possible	Number spp. likely	Number spp. present	Percent of likely spp.
Insectivora	3	1	0	0
Chiroptera	19	16	2	12
Lagomorpha	3	3	2	67
Rodentia	30	24	18	75
Carnivora	16	13	3	23
Artiodactyla	3	2	0	0
Total	74	59	25	42%

Table 10. Current working list of mammals from Salinas Pueblo National Monument.

Common Name	Park Status	Reference/Observation
Merriam's shrew	Unconfirmed	
montane shrew	Unconfirmed	
dwarf shrew	Unconfirmed	
desert shrew	Probably Present	
southwestern myotis	Unconfirmed	
California myotis	Probably Present	
western small-footed bat	Probably Present	
long-eared myotis	Probably Present	
little brown bat	Probably Present	
fringed myotis	Present	USGS voucher, 2001
long-legged myotis	Present	USGS voucher, 2001
Yuma myotis	Present	USGS voucher, 2001
silver-haired bat	Probably Present	
western pipistrelle	Probably Present	
big brown bat	Present	USGS voucher, 2001
eastern red bat	Probably Present	
hoary bat	Present	USGS voucher, 2001
spotted bat	Probably Present	
Western big-eared bat	Present	USGS voucher, 2001
pallid bat	Present	USGS voucher, 2001
Brazilian free-tailed bat	Probably Present	
big free-tailed bat	Probably Present	
desert cottontail	Present	USGS observation, 2001
eastern cottontail	Probably Present	
black-tailed jack rabbit	Present	USGS observation, 2001
Colorado chipmunk	Present	USGS capture, 2001
Texas antelope squirrel	Probably Present	
spotted ground squirrel	Unconfirmed	
thirteen-lined ground squirrel	Unconfirmed	
rock squirrel	Present	USGS observation, 2001
Gunnison's prairie dog	Unconfirmed	
black-tailed prairie dog	Unconfirmed	
Abert's squirrel	Unconfirmed	
red squirrel	Unconfirmed	
Botta's pocket gopher	Probably Present	
plains pocket gopher	Present	Findley et al., 1975; MSB
yellow-faced pocket gopher	Unconfirmed	
plains pocket mouse	Present	USGS capture, 2001
silky pocket mouse	Present	USGS capture, 2001

hispid pocket mouse	Unconfirmed	
Ord's kangaroo rat	Present	USGS voucher, 2001; Findley et al., 1975
banner-tailed kangaroo rat	Present	Findley et al., 1975
western harvest mouse	Present	USGS voucher, 2001
plains harvest mouse	Unconfirmed	
brush mouse	Present	USGS capture, 2001; Findley et al., 1975
white-footed mouse	Present	USGS capture, 2001; Findley et al., 1976
deer mouse	Present	USGS capture, 2001; Findley et al., 1977
piñon mouse	Present	USGS capture, 2001; Findley et al., 1978
rock mouse	Unconfirmed	
northern grasshopper mouse	Present	USGS capture, 2001; Findley et al., 1975
hispid cotton rat	Present	USGS voucher, 2001
white-throated woodrat	Present	USGS capture, 2001; Findley et al., 1975
Mexican woodrat	Present	Findley et al., 1975
southern plains woodrat	Present	?+G65MSB?
long-tailed vole	Present	USGS capture, 2001; pending identification
Mexican vole	Probably Present	
muskrat	Unconfirmed	
house mouse	Present	USGS capture, 2001
porcupine	Present	USGS observation, 2001
coyote	Present	USGS observation, 2001; Findley et al., 1975
gray wolf	Present Historically	Bailey, 1932
kit fox	Probably Present	see Findley et al., 1975 for nearby locality
red fox	Probably Present	
gray fox	Probably Present	
American black bear	Probably Present	
grizzly bear	Unconfirmed	Likely occurred historically
ringtail	Probably Present	
raccoon	Probably Present	
ermine	Unconfirmed	
long-tailed weasel	Probably Present	
black-footed ferret	Unconfirmed	may have occurred historically
badger	Present	Findley et al., 1975
western spotted skunk	Probably Present	
striped skunk	Probably Present	
mountain lion	Probably Present	
bobcat	Probably Present	
wapiti	Unconfirmed	
mule deer	Present	USGS observation, scat, 2001
pronghorn	Probably Present	
bison	Unconfirmed	may have occurred historically
bighorn sheep	Unconfirmed	current bighorn are transplants from northern NM

Table 11. Current level of documentation for major groups of mammals on SAPU.

Order	Number spp. possible	Number spp. likely	Number spp. present	Percent of likely spp.
Insectivora	4	1	0	0
Chiroptera	18	17	7	41
Lagomorpha	3	3	2	67
Rodentia	34	23	20	87
Carnivora	17	14	3	21
Artiodactyla	5	2	1	50
Total	81	60	33	55%

Table 12. Current working list of mammals from Yucca House National Monument and Ismay property.

Common Name	Park Status	Reference or Observation
Merriam's shrew	Unconfirmed	
dwarf shrew	Unconfirmed	
Preble's shrew	Unconfirmed	
desert shrew	Probably Present	
California myotis	Present	USGS voucher, 2001
western small-footed bat	Present	USGS voucher, 2001
long-eared myotis	Present	USGS voucher, 2001
little brown bat	Unconfirmed	
fringed myotis	Present	USGS voucher, 2001
long-legged myotis	Present	USGS voucher, 2001
Yuma myotis	Probably Present	
silver-haired bat	Probably Present	
hoary bat	Present	USGS capture, 2001
western pipistrelle	Present	USGS vocalization, 2001
big brown bat	Present	USGS voucher, 2001
spotted bat	Present	USGS vocalization, 2001
Townsend's big-eared bat	Probably Present	
Allen's big-eared bat	Unconfirmed	
pallid bat	Present	Armstrong, 1972; Moqui
Brazilian free-tailed bat	Present	USGS vocalization, 2001
big free-tailed bat	Present	USGS vocalization, 2001
desert cottontail	Present	USGS observation, 2001
Nuttall's cottontail	Present	M. Colyer, MEVE, 2001
black-tailed jack rabbit	Present	Armstrong, 1972; Moqui
Hopi chipmunk	Probably Present	Armstrong, 1972; Moqui
least chipmunk	Probably Present	see Armstrong, 1972
white-tailed antelope squirrel	Present	Armstrong, 1972; Moqui
rock squirrel	Present	USGS observation, 2001
Gunnison's prairie dog	Present	USGS observation, 2001
Botta's pocket gopher	Present	Armstrong, 1972; Moqui
plains pocket mouse	Probably Present	= apache
silky pocket mouse	Present	Armstrong, 1972; Moqui
Ord's kangaroo rat	Present	Armstrong, 1972; Moqui
beaver	Present	M. Colyer, MEVE, 2002
western harvest mouse	Present	USGS capture, 2001
brush mouse	Present	USGS voucher, 2001
canyon mouse	Probably Present	Armstrong, 1972; Moqui
deer mouse	Present	USGS voucher, 2001

piñon mouse	Present	USGS voucher, 2001
northern grasshopper mouse	Probably Present	
white-throated woodrat	Present	USGS voucher, 2001
bushy-tailed woodrat	Probably Present	Armstrong, 1972; Moqui
Mexican woodrat	Probably Present	Armstrong, 1972; Moqui
long-tailed vole	Unconfirmed	
Mexican vole	Unconfirmed	
muskrat	Present	M. Colyer, MEVE, 2002
house mouse	Present	M. Colyer, MEVE, 2002
porcupine	Present	M. Colyer, MEVE, 2002
coyote	Present	USGS observation, 2001
gray wolf	Unconfirmed	Likely occurred historically
kit fox	Present	Armstrong, 1972; McElmo Can.
red fox	Probably Present	
gray fox	Present	Armstrong, 1972; "McElmo"
American black bear	Present	M. Colyer, MEVE, 2002
grizzly bear	Unconfirmed	Likely occurred historically
ringtail	Probably Present	
raccoon	Present	M. Colyer, MEVE, 2002
long-tailed weasel	Present	Armstrong, 1972; Ute Peak
black-footed ferret	Unconfirmed	may have occurred historically
badger	Present	USGS observation, 2001
western spotted skunk	Present	Armstrong, 1972; Moqui
striped skunk	Present	M. Colyer, MEVE, 2002
mountain lion	Present	M. Colyer, MEVE, 2002s
bobcat	Present	M. Colyer, MEVE, 2002
wapiti	Present	M. Colyer, MEVE, 2002
mule deer	Present	M. Colyer, MEVE, 2002
pronghorn	Present	M. Colyer, MEVE, 2002
bighorn sheep	Present	M. Colyer, MEVE, 2002

Table 13. Current level of documentation for major groups of mammals on YUHO.

Order	Number spp. possible	Number spp. likely	Number spp. present	Percent of likely spp.
Insectivora	4	1	0	0
Chiroptera	17	15	12	80
Lagomorpha	3	3	3	100
Rodentia	23	21	14	67
Carnivora	16	13	11	84
Artiodactyla	2	4	4	100
Total	65	57	45	78%